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BUREAU OF MINES MINERALS YEARBOOK

The Mineral Industry of Other South Pacific Islands

UNITED STATES DEPARTMENT OF THE INTERIOR

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UNITED STATES DEPARTMENT OF THE INTERIOR • Manuel J. Lujan, Jr., Secretary

BUREAU OF MINES • T S Ary, Director

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The Mineral Industry of Other South Pacific Islands

By Travis Q. Lyday[1]

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INTRODUCTION

The Other South Pacific Island states extend from Palau, also called Belau, near the Philippines in the west, to French Polynesia in the east. However, a number of countries and territories have been omitted from this chapter because their mineral production was insignificant to the local economy. These include the French overseas territories of French Polynesia and Wallis and Futuna Islands; independent states, including Kiribati, Marshall Islands, Micronesia, Palau, Tonga, Tuvalu, and Vanuatu; the New Zealand freely associated state of the Cook Islands, and the New Zealand dependency of Niue. What mineral production existed in these islands was limited to construction materials such as coral reef limestone, crushed stone, and sand and gravel in minor quantities solely for domestic consumption.

FIJI

The mineral industry of Fiji continued to be dominated by gold, although this sector contributed less than 1% to the gross domestic product (GDP) of the country. Gold and silver together ranked second in value among the country's exports. Fiji's economy contracted 11% during the 8-month period following the first, on May 14, of two military coups. Although the island nation had been a member of the British Commonwealth of Nations since its independence on October 10, 1970, Fiji's membership terminated with the emergence of the Republic of Fiji on October 15.

The main mineral resources of Fiji were gold-silver telluride deposits, porphyry copper and volcanogenic base metal deposits, residual bauxite and phosphate deposits, and heavy-mineral sands. Manganese had been mined on a small scale.

The largest and most important mining operation in Fiji was the Vatukoula gold-silver mine in the north of the main island of Viti Levu. The mine, also called the Emperor, also had produced significant amounts of tellurium in the past. The Vatukoula Mine was managed and operated by Western Mining Corp. (Fiji) Ltd. (WMCF), a

wholly owned subsidiary of Western Mining Corp. Holdings Ltd. of Australia, in joint venture with Emperor Gold Mining Co. Ltd. WMCF held a 20% interest in the Vatukoula Mine.

The Vatukoula operation continued as Fiji's only metallic mineral producer in 1987, mining by both open cut and underground methods, with 60% of the ore mined underground. The mine produced more than 100,000 troy ounces of gold in the 12 months ending June 30, 1987, the first time that figure had been reached since 1970. Profits for the period were $14.6 million[3] compared with $2 million in fiscal year 1986.

Other active mining in Fiji included quarries for stone and crushed gravel, limestone for cement and lime production, and coral and river sand dredging, all exclusively for domestic use.

Several major mining firms continued to explore for minerals, especially gold, throughout Fiji. A number of small high-grade epithermal deposits were under evaluation, although no major discoveries had been announced by yearend.

Freeport-McMoRan Australia Ltd. explored for epithermal gold on the islands of Kadavu and Ono during the year, reporting assays as high as 0.17 ounce of gold per short ton and up to 7 ounces of silver per short ton on Ono, with gold values up to 0.06 ounce of gold per short ton on eastern Kadavu.

United Resources (Fiji) Ltd., a wholly owned subsidiary of the Australian mining company City Resources Ltd., applied for Special Prospecting Licenses (SPL) covering most of the Yasawa Islands northwest of Viti Levu as a result of encouraging stream sediment samples obtained in a regional reconnaissance program.

Another Australian company, Solomon Pacific Resources NL, conducted a channel sampling and drilling program at former underground workings at the Wainivesi gold prospect, 70 kilometers north of Suva. Solpac (Fiji) Ltd., a wholly owned subsidiary, earned a 90% interest in the property from the joint-venture partner Geopacific Ltd.

Australian-based Climax Mining Ltd. completed its program of reverse circulation percussion drilling at its Faddy gold prospect in the Mistry SPL on Viti Levu, 16 kilometers south of Nadi. Results showed a significant gold sulfide-bearing zone of 2 million tons of probable ore grading 0.06 ounce of gold per short ton. Preliminary metallurgical testing on samples from a section of the sulfide mineralization obtained +90% gold recoveries with low cyanide consumption.

Pacific Islands Gold (Fiji) Ltd., a wholly owned subsidiary of Pacific Islands Gold NL, signed a joint-venture agreement with Climax Mining. Under the agreement Climax Mining will operate Pacific Islands' (Fiji) 1,320-hectare Koroisa SPL, adjacent on the south to Climax Mining's Mistry SPL about 20 kilometers south of Nadi, and can earn a 50% interest in the property. Pacific Islands (Fiji) and Climax Mining also filed an application for an SPL immediately south of the Koroisa SPL.

In midyear, the close-spaced diamond-drilling exploration on the Mount Kasi gold prospect in southwestern Vanua Levu yielded higher data about probable reserves. The program was a joint venture by Newmont Pty. Ltd., 65%, and Range Resources Ltd., 35%. The initial estimate had been 370,000 tons of ore grading 0.13 ounce of gold per short ton. New assay results indicated varying intervals of gold mineralization, ranging up to 0.25 ounce of gold per short ton over a 25-meter interval in one hole. The drilling was originally to delineate reserves for a proposed 50,000-ton-per-year open pit, but by yearend, the venture was considering a 1.0- to 1.5-million-ton-per-year pit, mining both hard rock and eluvial material. The eluvial portion was reported to contain 1.8 million tons of ore grading 0.05 ounce of gold per short ton, recoverable with cyanide and without crushing or grinding. The reserve and grade of the hard-rock portion of the ore body were not available.

Pacific Islands (Fiji) reportedly discovered an extensive zone of epithermal gold mineralization on the 4,500-hectare Dakuniba SPL in southeastern Vanua Levu. Up to 0.31 ounce of free-milling gold per short ton was obtained from rock chip and float sampling. United Resources was to provide $170,500 to initiate a major drilling program in early 1988 to assess the prospect as well as earn a 50% interest in the SPL.

Japan and France planned to conduct a 5-year survey of the sea bottom, at least 3,000 meters deep, in the southwestern Pacific Ocean near Fiji. The objective was the search for hydrothermal base metal deposits.

Approximately 60% of Fiji was covered by SPL's in 1987.

Table 1.—Other South Pacific Islands: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Area and commodity	1983	1984	1985	1986[p]	1987[p]
FIJI					
Cement, hydraulic	100,900	97,900	93,200	92,278	96,000
Gold, mine output, Au content troy ounces	40,124	48,515	60,707	94,902	85,000
Lime[2]	[e]2,500	[e]2,500	3,261	2,305	2,000
Silver, mine output, Ag content troy ounces	13,021	15,297	14,198	17,062	16,000
Stone, sand and gravel:[e]					
Coral sand for cement manufacture	95,000	95,000	126,500	160,900	170,000
River sand for cement manufacture	28,000	25,000	40,000	39,500	40,000
River sand and gravel, n.e.s. cubic meters	375,000	350,000	1,200,000	577,500	600,000
Quarried stone do.	225,000	225,000	105,000	150,000	150,000
NAURU[3]					
Phosphate rock thousand tons	1,684	1,358	1,508	1,494	[e]1,376
NEW CALEDONIA					
Cement	[e]60,000	[e]60,000	[e]60,000	40,000	50,000
Chromite, gross weight	91,380	84,152	149,476	163,325	152,756
Cobalt, mine output:					
Content by analysis[5]	1,540	2,006	2,541	2,187	1,953
Recovered[6]	161	103	124	105	96
Nickel:					
Ore:					
Gross weight thousand tons	2,200	2,886	3,600	3,125	[e]2,790
Ni content	46,162	58,326	72,360	61,800	56,100
Metallurgical products:					
Ferronickel:					
Gross weight[e]	84,700	113,700	140,800	[e]130,500	115,600
Metal content (nickel plus cobalt)	21,717	29,158	36,103	33,001	[e]29,531
Nickel matte:					
Gross weight[e]	6,200	7,600	12,100	12,200	11,300
Metal content (nickel plus cobalt)	4,578	5,462	8,905	9,160	[e]8,283
Stone, sand and gravel:[e]					
Stone:					
Crude (unspecified) cubic meters	19,000	20 000	20,000	20,000	20,000
Crushed do.	90,000	90,000	90,000	100,000	100,000
Sand do.	60,000	60,000	60,000	75,000	75,000
Silica (for metallurgical use) do.	15,000	15,000	15,000	15,000	15,000
PAPUA NEW GUINEA[3]					
Copper, mine output, Cu content	201,876	164,447	175,048	178,211	[e]217,699
Gold, mine output, Au content troy ounces	579,407	[e]835,000	1,186,618	1,127,586	[e]1,069,011
Silver, mine output, Ag content do.	1,524,360	1,427,491	1,482,533	1,787,000	1,963,315
SOLOMON ISLANDS[3]					
Gold, mine output, Au content do.	[e]1,100	2,572	[e]2,090	[e]4,000	4,000
Silver, mine output, Ag content do.	[e]250	--	--	--	--

[e]Estimated. [p]Preliminary.

[1]Table includes data available through August 1, 1988.

[2]Produced from an unreported amount of domestically quarried limestone.

[3]In addition to the commodities listed, crude construction materials (common clays, sand and gravel, and stone) are produced, but output is not reported quantitatively, and available general information is inadequate to make reliable estimates of output levels.

[4]Reported figure.

[5]Cobalt content of nickel ores computed assuming average cobalt content to be 0.07%.

[6]Cobalt actually recovered for use as cobalt; excludes cobalt content of nickel-cobalt alloys and/or included in ferronickel.

Table 2.—Fiji: Exports and reexports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Principal destinations, 1985
METALS			
Aluminum: Metal including alloys:			
Scrap	33	33	Australia 10; New Zealand 10.
Unwrought and semimanufactures	--	19	Mainly to Hong Kong.
Copper: Metal including alloys:			
Scrap	180	143	All to Australia.
Semimanufactures	--	30	Mainly to Australia.
Iron and steel: Metal:			
Scrap	1,810	717	New Zealand 558.
Steel, primary forms	--	2	All to unspecified Oceania.
Semimanufactures[2]	521	363	Tonga 168; American Samoa 52; New Zealand 35.

See footnotes at end of table.

Table 2.—Fiji: Exports and reexports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity		1984	1985	Principal destinations, 1985
METALS —Continued				
Lead: Metal including alloys, scrap		34	18	All to New Zealand.
Silver:				
Waste and sweepings	value, thousands	$2	--	
Metal including alloys, unwrought and partly wrought	do.	$123	$89	All to Australia.
INDUSTRIAL MINERALS				
Abrasives, n.e.s.: Grinding and polishing wheels and stones	value, thousands	$4	--	
Cement		4,566	8,300	Samoa 3,121; Tonga 2,958; American Samoa 1,602.
Clays, crude		1	--	
Salt and brine		129	--	
Stone, sand and gravel:				
Gravel and crushed rock		--	131	Australia 126.
Sand other than metal-bearing		--	2	NA.
Other: Slag and dross, not metal-bearing		--	15	All to Australia.
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Liquefied petroleum gas	42-gallon barrels	58	25	Tuvalu 23.
Gasoline	do.	149,660	134,851	Tonga 37,740; Samoa 26,240; Cook Islands 19,873.
Kerosene and jet fuel	do.	714,783	743,264	Cook Islands 33,472; Tonga 29,721; ship stores 604,252.
Lubricants	do.	2,065	1,225	New Zealand 168; Tuvalu 119; ship stores 637.
Residual fuel oil	do.	299,314	331,295	Tonga 61,732; Samoa 55,131; ship stores 130,956.
Unspecified	do.	6	--	

NA Not available.

[1]Table prepared by Audrey D. Wilkes. Fiji did not report any exports of mineral commodities to the continental United States during 1985.

[2]Totals exclude unreported quantities valued at $40,000 in 1984 and $12,000 in 1985.

Table 3.—Fiji: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
METALS				
Aluminum: Metal including alloys, all forms	562	541	(2)	New Zealand 441; Australia 60.
Copper: Metal including alloys, all forms	99	118	5	Australia 55; New Zealand 36.
Iron and steel: Metal:				
Pig iron, cast iron, related materials	73	36	--	Japan 31.
Ferroalloys	1	3	--	All from New Zealand.
Steel, primary forms	12,909	9,242	1	Australia 5,824; New Zealand 2,766.
Semimanufactures:				
Bars, rods, angles, shapes, sections	4,788	6,386	61	New Zealand 2,538; Japan 1,656; Hong Kong 795.
Universals, plates, sheets	11,803	12,367	7	Australia 6,067; New Zealand 3,554; Japan 1,748.
Hoop and strip	402	421	--	Australia 318; New Zealand 80.
Rails and accessories value, thousands	$69	$271	--	United Kingdom $113; Japan $97.
Wire	2,150	2,375	--	Australia 1,920; New Zealand 301.
Tubes, pipes, fitting[3]	2,114	3,447	--	Australia 1,371; Japan 484; New Zealand 183.
Castings and forgings, rough	1	--		
Lead:				
Oxides	81	42	--	Australia 26; West Germany 11.
Metal including alloys, unwrought and semimanufactures value, thousands	$32	$47	--	New Zealand $15; United Kingdom $14; Australia $13.
Silver: Metal including alloys, unwrought and partly wrought do.	$8	$4	--	Australia $3.
Tin: Metal including alloys, all forms do.	$2,433	$1,535	--	Japan $1,532.
Titanium: Oxides	254	359	73	Australia 285.
Zinc: Metal including alloys, all forms	32	(2)	--	Mainly from Australia.
Other: Ores and concentrates	15	--		

See footnotes at end of table.

Table 3.—Fiji: Imports of mineral commodities[1] —Continued

(Metric tons unless otherwise specified)

Commodity	1984	1985	Sources, 1985	
			United States	Other (principal)
INDUSTRIAL MINERALS				
Abrasives, n.e.s.:				
Natural: Corundum, emery, pumice, etc	43	58	--	New Zealand 37; Australia 21.
Grinding and polishing wheels and stones value, thousands	$70	$93	$2	New Zealand $37; Australia $29.
Barite and witherite	25	76	--	New Zealand 73.
Boron materials: Crude natural borates	1	--	--	
Cement	3,492	6,069	--	Australia 5,504.
Clays, crude	42	83	11	New Zealand 31; Australia 21.
Diatomite and other infusorial earth	104	58	17	Australia 22; Japan 19.
Fertilizer materials:				
Crudes, n.e.s	5	28	--	All from New Zealand.
Manufactured:				
Nitrogenous	59,376	30,598	--	Republic of Korea 18,583; Japan 9,851.
Phosphatic	13,897	4,689	--	Republic of Korea 3,005; Japan 1,050.
Potassic	5,835	1,792	--	Republic of Korea 1,132; Singapore 500.
Unspecified and mixed	464	1,228	--	West Germany 535; New Zealand 342.
Graphite, natural	1	--	--	
Gypsum and plaster	5,040	40	--	Australia 24; New Zealand 16.
Lime	170	287	--	All from New Zealand.
Magnesium compounds: Magnesite, crude including calcined	2	3	--	All from Australia.
Mica:				
Crude including splittings and waste	3	19	--	All from New Zealand.
Worked including agglomerated splittings value, thousands	$1	$7	--	China $2; Australia $1.
Nitrates, crude	36	107	54	Australia 36.
Potassium salts, crude	11	--	--	
Salt and brine	3,425	2,769	11	West Germany 2,459.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked	15	43	--	Australia 28; India 13.
Worked value, thousands	$35	$32	--	New Zealand $15; Australia $8.
Gravel and crushed rock	17	22	--	Australia 17.
Limestone other than dimension	6	10	--	All from New Zealand.
Quartz and quartzite	2	--	--	
Sand other than metal-bearing	69	30	--	New Zealand 25.
Sulfur:				
Elemental:				
Crude including native and by-product	3	--	--	
Colloidal, precipitated, sublimed	1	1	--	All from Australia.
Sulfuric acid	125	68	--	New Zealand 41; Australia 27.
Talc, steatite, soapstone, pyrophyllite	92	70	--	Australia 36; New Zealand 34.
Other:				
Crude	93	204	--	New Zealand 145.
Slag and dross, not metal-bearing	1	(4)	--	All from New Zealand.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,313	2,199	--	Hong Kong 2,000.
Carbon black value, thousands	$172	$48	$8	Australia $27; United Kingdom $10.
Coal, all grades including briquets	22,343	16,453	(5)	Mainly from Australia.
Coke and semicoke	2	6	--	Australia 5.
Peat including briquets and litter	5	5	--	All from New Zealand.
Petroleum refinery products:				
Liquefied petroleum gas 42-gallon barrels	44,857	46,191	--	Australia 46,180.
Gasoline do.	532,942	537,931	--	Australia 427,746; Singapore 109,871.
Mineral jelly and wax do.	362	637	--	China 472; Australia 87.
Kerosene and jet fuel do.	852,516	945,384	--	Australia 699,639; Singapore 245,567.
Lubricants do.	25,837	25,501	--	Australia 20,552.
Residual fuel oil do.	1,020,112	1,124,061	--	Australia 991,288; Singapore 132,794.
Bitumen and other residues do.	6	36	--	New Zealand 24.
Bituminous mixtures do.	279	133	--	United Kingdom 73; New Zealand 30.

[1]Table prepared by Audrey D. Wilkes.
[2]Less than 1/2 unit.
[3]Totals exclude unreported quantities valued at $722,000 in 1984 and $630,000 in 1985.
[4]Unreported quantity valued at $133,000.
[5]Unreported quantity valued at $3,000.

NAURU

The Nauruan economy continued to be based on extensive high-grade phosphate deposits on the central plateau of the island, although annual production continued to fall because of increased competition from Jordan and Morocco. The phosphate had a guaranteed content of 84% BPL (bone phosphate of lime or tricalcium phosphate), equivalent to 38.5% phosphorus pentoxide (P_2O_5). It was the highest grade phosphate rock available to industry.

Nauru's sole export remained phosphate, mined and marketed by the Nauru Phosphate Corp. (NPC), an agency of the Government of Nauru. NPC assumed full control of the phosphate industry from the British Phosphate Commission (BPC) shortly after independence was achieved in 1968. However, BPC, headed by representatives of Australia, New Zealand, and the United Kingdom, was not terminated until early February 1987 at an official ceremony in Canberra, Australia.

The Government formed an independent commission in February, the Nauru Rehabilitation Inquiry, which was empowered to examine two issues: who was responsible for rehabilitating the land worked out by phosphate mining before independence, and the feasibility and cost of such rehabilitation. The commission was formed to persuade, or force, the BPC members to accept some of the responsibility for restoring the island, now more than 75% devastated. The commission was to send its recommendations to the Government in 1988. The Government then would decide whether to initiate any compensation claims under international law. Investments in nonmining activities over the years, along with interest payments received, have accrued the BPC an estimated $35 million.[a] If the Government determines that reparations for past mining are appropriate, it would seek a portion of these funds, reportedly about $21 million.

Production of phosphate rock in 1987, mined by clamshell buckets from deposits interdigitated with evenly spaced dolomitized coral limestone pinnacles, decreased 8%. All production was exported to Australia (see table 1). Coral mined with the phosphate was removed by hand for domestic use as road aggregate.

Table 4.—Nauru: Exports of phosphate rock, by destination

(Thousand metric tons)

Destination	1985	1986	1987
Australia	925.0	869.4	1,061.9
Japan	—	—	4.3
Korea, Republic of	14.0	22.1	38.2
New Zealand	339.6	122.7	202.9
Philippines	229.7	469.3	68.2
Total	1,508.3	1,493.5	1,375.5

Source: Phosphate Rock Statistics, International Fertilizer Industry Association Ltd.

NEW CALEDONIA

The mineral industry in the French Territory of New Caledonia and Dependencies continued to be dominated by the mining of nickel from lateritic ore and the subsequent production of ferronickel of various grades and of nickel matte; chromite produced from extensive ultramafic rock; and certain pit and quarry construction materials. However, the island territory is well endowed with additional resources; significant prospects have been reported for antimony, copper, gold, iron ore, lead-zinc, manganese, and phosphate. None has been mined commercially.

LeNickel-SLN, a wholly owned subsidiary of France's Société Métallurgique le Nickel, mined nickel at Kouaoua (Meaba Mine) and Thio (Camp des Sapins and Le Plateau Mines) on the east coast of the island of New Caledonia and produced ferronickel and nickel matte at its Doniambo smelter at Noumea.

LeNickel-SLN continued to smelt most of the company's own nickel ore, but it shipped some material to Japan for processing and smelting and about 30,000 tons of ore to Australia's Dallhold Investments Pty. Ltd.'s Yabulu smelter at Townsville, Queensland. The 52,000-ton-per-year Doniambo smelter also processed ore from smaller, independently owned mines. Minor amounts of cobalt were recovered from exports of nickel matte refined in Le Havre, France.

In December, the Japanese Government altered its general preferential tariff system to raise the ceiling on imports of nickel ore from New Caledonia. New Caledonia was reclassified as a separate country under a new system that would allow imports at a lower tariff. The new system was to go into effect April 1, 1988. The ceiling on nickel ore from New Caledonia was raised from 3.8 million to 5.6 million tons per year.

LeNickel closed down one of its three electric furnaces at the Doniambo smelter

in midyear for 4 months of maintenance, reducing contained nickel output by more than 4,000 tons to 37,814 tons. LeNickel announced in September plans to return to full operational capacity in 1988 with a production target of 45,000 tons of contained nickel. LeNickel last reached maximum output in 1985, despite sabotage at LeNickel mines and work stoppages by separatist Melanesian Kanaks. LeNickel also continued reducing costs by trimming 250 personnel, to about 2,050, during the year. Wage rates were about 15% higher in New Caledonia than in Canada, the world's largest nickel producer.

Cromical S.A. produced refractory-grade (low-silica, high-grade fines) chromite ore in addition to high-grade lumpy ore and high-grade fines from its underground Tiebaghi Mine in the northern part of the island of New Caledonia. Proven reserves were sufficient for at least 3 years of operation.

Australmin Pacific Ltd. conducted offshore drilling at its Baie des Pirgues chromite prospect, identifying an alluvial resource of 230 million tons of ore at a grade of 3.5% Cr_2O_3. The prospect is in shallow water sediments along the southwestern coast of the main island, approximately 30 kilometers southeast of Noumea. Additional drilling identified that chromite resources in the adjacent Baie des Ngo and Baie des Ouie.

PAPUA NEW GUINEA

Although Papua New Guinea has immense natural resources, including minerals, its economy remained basically agrarian, depending chiefly on cocoa, coffee, copra, and palm oil. Agriculture accounted for about one-third of both the GDP, estimated to be $2.5 billion,[4] and foreign exchange earnings from exports. However, the country's mineral industry was the second most important sector of the economy in 1987, accounting for about one-fifth of the GDP and more than one-half of total export receipts.

Comprehensive mineral exploration in Papua New Guinea since the late 1960's has resulted in the development of two major mines and the discovery of several promising prospects. The first mine to be developed, Bougainville Copper Ltd.'s (BCL) copper-gold-silver mine at Panguna, was brought into production in 1972 on Bougainville Island, North Solomons Province. BCL was owned by CRA Ltd., 53.6%; the Papua New Guinea Government, 20%; and by public shares, 26.4%. The mine ranked as the fourth largest copper mine in the world in 1987. The Ok Tedi copper-gold-silver mine on Mount Fubilan in the Star Mountains of Western Province, 25 kilometers from the border of the Indonesian Province of Irian Jaya, began production in May 1984. Ok Tedi was owned by BHP-Utah Minerals International Inc., which also assumed direct responsibility as managing shareholder of Ok Tedi Mining Ltd. (OTML), the operating company, on October 1, and Amoco Minerals Co. (Standard Oil Co., Indiana), 30% each; a consortium of Metallgesellschaft AG and Degussa AG, 7.5% each, and the state-owned West German Development Co., 5.0%; and the Papua New Guinean Government, 20%.

The open-cut Panguna Mine is in difficult terrain about 600 meters above sea level. After milling, the concentrate is pumped 25 kilometers through a slurry pipeline to the port of Anewa where it is shipped to the Federal Republic of Germany, Japan, and Spain under long-term contracts, and to China and the Republic of Korea under short-term contracts. Contained metal in concentrate produced at the Panguna Mine in 1987 was 178,211 tons of copper, 485,090 ounces of gold, and 1,626,793 ounces of silver. Milled was 48.2 million tons of ore grading 0.41% copper, 0.1 ounce of gold per short ton, and 0.04 ounce of silver per short ton.

Bechtel Australia Pty. Ltd. started detailed engineering and earthwork construction on a $50 million, 32-kilometer, 0.86-meter-diameter gravity-flow slurry pipeline to transport mine tailings to the Solomon Sea, thus using the height of the mine site to economic advantage. Pipeline construction was scheduled to commence in late 1988. When completed in 1990, the facility will be the world's largest and longest gravity-flow slurry pipeline. Currently, the tailings are transported through a short pipeline to the upper regions of the Jaba River Valley, a method that has caused considerable sediment buildup along the river.

Recoverable ore reserves at yearend were estimated to be 533 million tons, suitable for a mine life of an additional 10 to 15 years. BCL petitioned the Government in December to lift the moratorium on minerals and petroleum exploration on Bougainville Island, imposed in 1971 when the traditional landowners on the island protested the opening of the Panguna Mine. BCL officials have said that if they are to develop another mine in the region, they must begin exploring as soon as possible. A $30 million, 35-million-ton-per-year preconcentration

screening facility was completed early in the year. This provided BCL greater flexibility in treating declining ore grades and maintaining production at competitive costs. However, the facility's performance was below target initially, and it was modified to improve its efficiency.

The Ok Tedi Mine commenced production of copper concentrate in July when its concentrator came on-stream, a year earlier than originally planned. The mine had been stockpiling ore in large quantities. The production rate of the concentrator was scheduled to increase from 27,000 tons per day at yearend to 70,000 tons per day. The mining of copper ore increased as more was exposed by the mining of the leached gold-rich capping. A second gold plant was started up in midyear, accelerating the mining of the gold cap, which would be largely depleted during the latter part of 1988. The Ok Tedi Mine produced 39,488 tons of copper, 583,921 ounces of gold, and 336,521 ounces of silver in concentrate in 1987.

In August, OTML signed an 8-year, $1.5 billion contract to supply copper concentrate to a consortium of seven Japanese trading and smelting companies that will take about 40% of Ok Tedi's output. The seven companies are Dowa Mining Co. Ltd.; Furukawa Co. Ltd.; Mitsubishi Metal Corp. Ltd.; Mitsui Mining and Smelting Co. Ltd.; Nittetsu Mining Co. Ltd.; MNC Metals and Development Co. Ltd.; and Sumitomo Metal Mining Co. Ltd. Shipments were to be 60,000 tons during 1987, 200,000 tons in 1988 and 230,000 tons per year over the succeeding 6 years. The contract would ensure continued operations at cash-short OTML and enable the Japanese firms to further diversity their supply. An additional 20% of output would be shipped to Norddeutsche Affinerie AG in the Federal Republic of Germany and about 15% would go to the Komsco smelter in the Republic of Korea. The remaining concentrate was to be sold on the spot market and to metals traders.

The first shipment of copper concentrate in bulk quantity on August 21 marked the beginning of stage II operations at Ok Tedi: the concurrent production of gold bullion and copper concentrate. The concentrate was conveyed from the mill site by a 160-kilometer slurry pipeline to the Fly River port of Kiunga where it was filtered, dried, and loaded onto barges for an 850-kilometer trip to the river's mouth. There it was transshipped to Japan and the Republic of Korea.

By December, all necessary approvals between Placer Pacific Ltd. and the Government were finalized for the imminent construction of the gold-silver mining project in eastern Misima Island, Milne Bay Province, 190 kilometers southeast of the main island of New Guinea. Under the terms of the Special Mining Lease (SML), Misima Mines Pty. Ltd., a subsidiary of Placer Pacific, was granted a 21-year right to mine. The Government was to obtain a 20% equity by providing its share of all exploration and development costs, excluding the development of the Alotau mining township for mine employees. Construction of the mine site was scheduled to start in early 1988, with plant commissioning scheduled for July 1989. Total capital investment was expected to be about $215 million. Revised estimated minable ore reserves at Misima were 56 million tons grading 0.4 ounce of gold per short ton and 0.61 ounce of silver per short ton, using a cut-off value of 0.2 ounce per short ton gold equivalent. Additional reserves were likely to be discovered.

Production during the commissioning period and the first year of commercial production was expected to be more than 400,000 ounces of gold and 2.6 million ounces of silver. Average annual production over the projected 10-year life of the mine, based on known reserves, was expected to be in excess of 210,000 ounces of gold and 2.1 million ounces of silver. The higher production at the beginning would be the result of treating higher grade ore initially while stockpiling lower grade material for processing later.

The Porgera gold-silver joint-venture project in the central highlands region of Enga Province on the main island continued progressing toward development, with mine construction expected to begin in mid-1988, contingent upon Government approval of the draft feasibility study, expected to be completed early in 1988, and the issuance of an SML. The Porgera deposit was owned equally by Placer Pacific operating as the manager, Renison Goldfields Consolidated Ltd., and Mount Isa Mines Ltd. Reserves were 4.5 million tons of ore grading 0.64 ounce of gold and 0.67 ounce of silver per short ton in the high-grade ore body, and 78 million tons grading 0.11 ounce of gold and 0.33 ounce of silver per short ton in the remainder of the deposit. It was considered one of the largest undeveloped gold deposits in the world, with an indicated gold content

of 12 million ounces. Construction of the mine site was expected to take 3 years from the granting of the SML. Two simultaneous mining operations were planned: an underground mine in the high-grade zone and an open pit. Production would be 800,000 ounces of gold per year for the first 5 years of mining, cutting back to an average of 640,000 ounces per year for the next 5 years.

Niugini Mining Ltd. began regular shipments near yearend of gold bullion from its small Mount Victor Mine near Kainantu, Chimbu Province, in the eastern highlands of the main island for refining in Australia. The 150,000-ton-per-year modular, transportable, carbon-in-pulp concentrator began operating in October. Annual gold production would be 15,000 ounces per year from a resource estimated at 314,000 tons grading 0.13 ounce of gold per short ton. Expected mine life was 4 years, but would increase if exploration drilling in the surrounding area identified additional reserves.

To the east of the Mount Victor Mine, in Morobe Province, Renison Goldfields completed the expansion of the mill from 400,000 to 476,000 tons of ore throughput at its Kerimenge gold mine near the old alluvial districts of Wau and Bulolo. Further modifications were being planned. Gold production increased from 5,658 to 20,737 ounces for the year ending June 30.

CRA conducted exploration drilling and engineering studies on its Hidden Valley gold prospect in the Morobe goldfield north of Wau. The deposit reportedly may contain 30 million to 50 million tons of ore grading 0.06 ounce of gold per short ton.

The Lihir Island Prospect on New Ireland Island in the Bismarck Archipelago, a joint venture by Kennecott Explorations (Australia) Ltd., 88% (acting as manager), and Niugini Mining, 12%, continued to be evaluated. Exploration drilling continued at the Minifie ore body, discovered in the fourth quarter of 1986. Preliminary estimated reserves were 22.5 million tons of sulfide ore grading 0.14 ounce of gold per short ton. All drill holes during the year were reported to have intersected ore-grade mineralization, and thus the boundaries of the ore body had not been determined. Reserves in the original Lihir discovery, the Lienetz ore body, were estimated by delineation drilling in 1986 to be 88.9 million tons of sulfide ore grading 0.8 ounce of gold per short ton and 8.1 million tons of oxide ore grading 0.6 ounce of gold per short ton.

Although no commercial petroleum or natural gas has been produced in Papua New Guinea, the country represents one of the largest unexplored potential oil provinces in the world. Despite repeated exploration failures since 1956, the area has the geologic potential for substantial deposits of oil. Exploration efforts remained concentrated around the Papuan Basin, consisting of the southern one-third of Papua New Guinea's main island and extending into the Gulf of Papua. These probes were stimulated by the discovery of the potentially large Iagifu Field by Chevron Oil Co. in 1986.

Table 5.—Papua New Guinea: Exports of copper in concentrates, by destination

(Metric tons of copper content)

Destination	1986	1987
China	9,297	9,296
Germany, Federal Republic of	62,513	54,270
Japan	77,373	61,675
Korea, Republic of	18,367	48,721
Spain	11,314	15,955
Unspecified	--	6,226
Total	178,774	196,283

Source: World Metal Statistics, July 1988.

SOLOMON ISLANDS

Mineral production in the Solomon Islands was limited to small quantities of clays, crushed stone, and sand and gravel used in domestic construction and minor amounts of alluvial gold.

Zanex Mavu, a joint venture by the Australian firm Zanex Ltd. (70%) and locally owned Mavu Gold Development Ltd. (30%), resumed operations at midyear. Its alluvial gold mine was in the Chovohio River at Mavu on the island of Guadalcanal, 30 kilometers southeast of the capital city of Honiara. The mine, the Solomon Islands only large-scale gold mine, was closed in 1986 when its recovery plant was destroyed by a cyclone. A secondhand plant was installed with a capacity of 17,000 ounces of gold per year. Installation of two additional recovery plants was under consideration at yearend, depending upon the results of bulk sampling to establish additional reserves, which would increase production to 50,000 ounces of gold per year.

Cyprus Minerals Australia Co., a subsidiary of Amoco Minerals Australia Co., continued its assessment of the large low-grade epithermal gold deposit in the Central Highland Range on Guadalcanal. Early in the year, Arimco NL agreed to spend $3.5 million[3] over a 3-year period for exploration and development in exchange for a 50% interest in the Gold Ridge prospect. In midyear, the Solomon Islands Foreign Investment Board approved the establishment of the new joint venture, Arimco (Solomon Islands) Ltd.

The Solomon Islands Parliament passed legislation governing the conditions for exploration and development of petroleum deposits. However, there have not been any reported hydrocarbon discoveries in the Solomon Islands.

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[1]Physical scientist, Division of International Minerals.

[2]Where necessary, values have been converted from Fijian dollars (F$) to U.S. dollars at the rate of F$0.8925 = US$1.00.

[3]Where necessary, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A$0.64 = US$1.00.

Mining Journal (London). V. 308, No. 7909, Mar. 20, 1987, p. 214.

[4]Where necessary, values have been converted from the Papua New Guinean kina (K) to U.S. dollars at the rate of K0.93 = US$1.00.

[5]Where necessary, values have been converted from the Solomon Islander dollar (SI$) to U.S. dollars at the rate of SI$2.06 = US$1.00.

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